SCIENCE 8 – ELECTROMAGNETIC SPECTRUM WORKSHEET

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NAME: _____

Vocabulary			
Electromagnetic radiation	Gamma rays	Radiant energy	Visible light
Electromagnetic spectrum	Infrared waves	Radio waves	Wavelength
Frequency	Microwaves	Ultraviolet rays	X rays

Use your notes from pages 9 – 10 and the terms in the vocabulary box to fill in the blanks for the following nine questions. You will not need to use every term.

1) The Electromagnetic Spectrum represents the different forms of electromagnetic radiation.

2) Light is classified as Electromagnetic radiation because electrical and magnetic fields vibrate in a light wave.

3) Radiant energy is energy that travels by radiation. An example of this is light.

4) Heat radiation, also known as Infrared waves, cannot be seen by your eyes but can be felt by your skin.

5) Microwaves are one type of electromagnetic radiat

6) Microwaves can be used to communicate with satellites.

7) Because gamma rays have the highest energy of all electromagnetic radiation, they are the most damaging to human tissue.

8) Compared to all other types of electromagnetic radiation, radio waves have the lowest frequency.

9) An overexposure to UV can result in sunburns and skin cancer.

10) Why does an empty plate not heat up in the microwave?

no water

Microwaves heat water & fat

11) Why should you use sunscreen and a hat when you are out in the Sun?

to block UV rays

Wave Worksheet #3 Name _____

Match each kind of wave with one item from column one and one item from column two.

COLUMN 1		WAVE		COLUMN 2
A. used in remote controls for TVs and VCRs	E	RADIO	M	**H.** used to find a broken bone or illegal plane carry-on
B. goes through most matter except bone and lead	F	MICROWAVE	I	**I.** used to kill bacteria on food
C. highest frequency and energy	A	INFRARED	N	**J.** ROY G. BV
D. can cause skin cancer or promote vitamin D production	G	VISIBLE	J	**K.** shortest wavelength
E. longest wavelength	D	ULTRAVIOLET	L	**L.** most dangerous waves
F. used to transmit cellular phone calls	B	X-RAY	H	**M.** TV signals, and used in remote control devices like car alarms and garage door openers
G. wavelengths and frequencies that can be seen by the human eye	C	GAMMA	K	**N.** radiant heat rays

15. As you go from left to right across the electromagnetic spectrum what happens to the frequency and energy of the waves? frequency increases radio → gamma

16. What happens to the speed of light as it enters a different medium? changes or slows down

17. Which color of the visible light portion of the electromagnetic spectrum has the highest frequency and the most energy? violet

18. Which color of the visible light portion of the electromagnetic spectrum has the lowest frequency and the least energy? red

19. What type of wave is a radio wave? EM wave an infrared wave? EM wave

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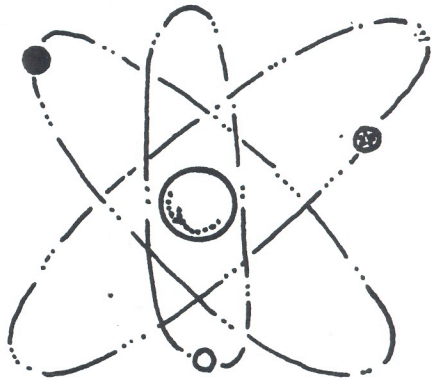
Name _____

A Amazing Atoms



An *atom* is the smallest particle of an element that has the same properties as the element. Atoms contain protons (positive), electrons (negative), and neutrons (neutral). Numbers used to describe extremely small or large quantities are often written in *scientific notation*. A number in scientific notation is the product of two factors: (a number greater than or equal to 1 that is less than 10) x (a power of 10).

Example 1: $0.0000000067 = 6.7 \times 0.000000001 = 6.7 \times 10^{-9}$

Example 2: $93{,}000{,}000 = 9.3 \times 10{,}000{,}000 = 9.3 \times 10^{7}$

Shortcut: The number of places the decimal point is moved is the exponent. The exponent is negative for small decimal numbers (those less than 1) and positive for large numbers (those greater than 1).

Write the following numbers pertaining to atoms in scientific notation. 9.1×10^{-25}

1. The mass of an electron is 0.000,000,000,000,000,000,000,000,9 1 mg. _____
2. The mass of a hydrogen atom is 0.000,000,000,000,000,000,001,67 mg. 1.67×10^{-21}
3. The diameter of a helium atom is 0.000,000,022 cm. 2.2×10^{-8}
4. The charge of an electron is 0.000,000,000,048 electrostatic units. 4.8×10^{-11}
5. If 1,000,000 hydrogen atoms were placed side by side, it would be less than the thickness of a sheet of notebook paper. 1×10^{6}
6. A hydrogen atom enlarged a quadrillion times (1,000,000,000,000,000) would be a hundred miles in diameter. 1×10^{15}
7. If an atom were enlarged to the size of a football field, the nucleus would be about the size of a pea and would weigh 3,000,000 tons. 3×10^{6}
8. A standard unit of measure for elements is the *mole* (*Avogadro's number*) which equals 602,200,000,000,000,000,000,000 elements. 6.02×10^{23}

Fascinating Fact *If all the empty space in your body's atoms could be removed, you would be no larger than a grain of sand.*

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Name Period

Scientific Notation – Practice and Review

	SCIENTIFIC NOTATION
1. Distance from the earth to the moon = 240,000 miles	2.4×10^5
2. Speed of Light = 186,000 miles / second	1.86×10^5
3. Escape velocity from earth = 25,000 miles / hour	2.5×10^4
4. Orbital velocity around the earth = 18,000 miles / hour	1.8×10^4
5. Distance from the Sun to Mercury = 35,960,000 miles	3.596×10^7
6. Distance from the Sun to Venus = 67,200,000 miles	6.72×10^7
7. Distance from the Sun to Pluto = 3,670,000,000 miles	3.67×10^9
8. Diameter of the earth = 7,900 miles	7.9×10^3
9. Diameter of Jupiter = 88,600 miles	8.86×10^4
10. Diameter of Saturn = 75,100 miles	7.51×10^4
11. Diameter of Saturn's ring system = 171,000 miles	1.71×10^5
12. Each square yard of the sun gives off energy equivalent to 70,000 horsepower	7×10^4
13. Alpha Centauri, the closest star to the sun, is 4.3 light years away or 25,000,000,000,000	2.5×10^{13}
14. A Light Year is approximately 5,900,000,000,000 miles	5.9×10^{12}

105

7

9

4

4

5

4

13

12

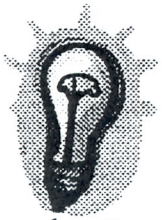
6.34×10^4

SPEED OF LIGHT

A. Definition – A **Light Year** is the distance that light travels in one year

B. Light travels at the rate of 186,282 miles per second or $\approx$ 100,000 times the distance (AU) Sun → Earth

Solar system to All

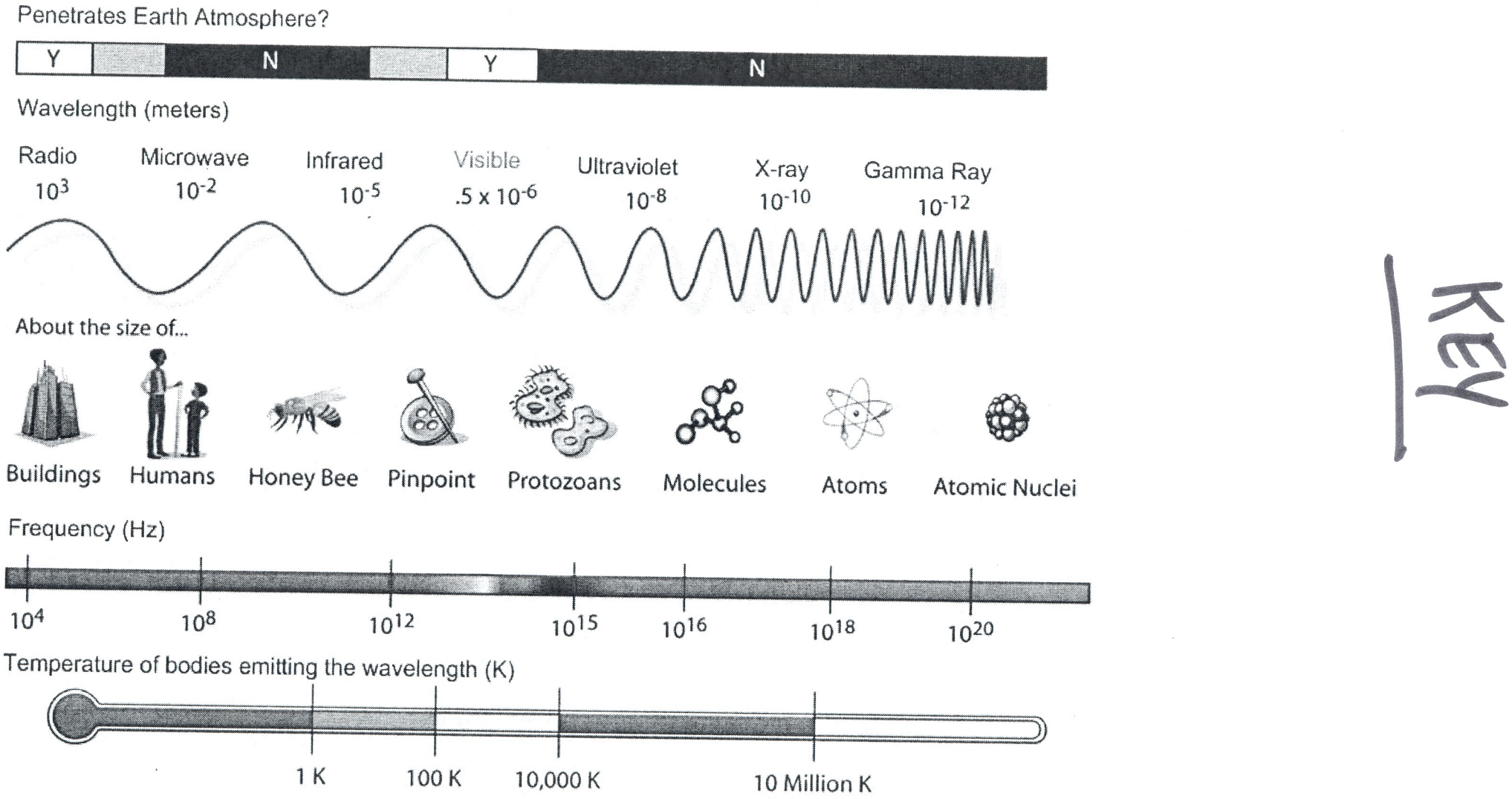


1. or _____ miles in 1 minute. ×60
2. or _____ miles in 1 hour. ×60
3. or _____ miles in 1 day (23 hours, 56 minutes) ×24
4. or _____ miles in 1 year (365 days, 6 hrs, 9 min. 10 sec.) ×365

C. How long will it take for the Sun's light to travel:

1. 93,000,000 miles to Earth 8 minutes
2. 141,710,000 miles to Mars 12 minutes
3. 483,880,000 miles to Jupiter 5×8 = 40 minutes
4. 3,675,270,000 miles to Pluto 8×40 = 320 minutes

The Electromagnetic Spectrum



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http://blogs.edf.org/climate411/wp-content/files/2007/07/ElectromagneticSpectrum.png

Return to "Era: Space Telescopes"

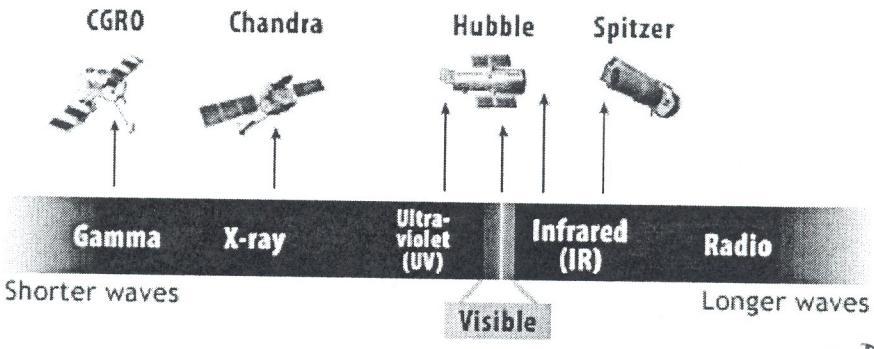
TELESCOPES FROM THE GROUND UP

28B

GET TO THE ROOT OF IT

An introduction to NASA's Great Observatories

The four Great Observatories are a series of space telescopes meant to give the most complete picture of objects across many different wavelengths. Each observatory studies a particular wavelength region in great detail.



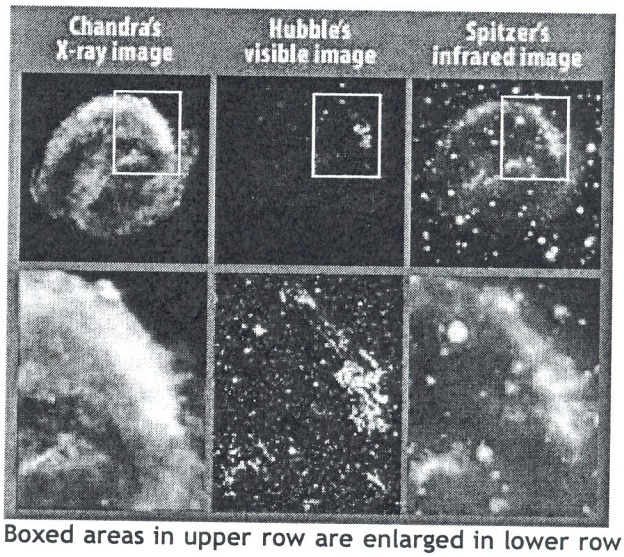
Webb 2013 Lauren
Infrared / Visible

The telescopes, in order of launch, are: the Hubble Space Telescope (1990), Compton Gamma Ray Observatory (1991), Chandra X-ray Observatory (1999), and Spitzer Space Telescope (2003). The chart at top right shows each telescope above the wavelength region it was built to observe. All except for CGRO are currently in orbit.

Using each telescope for what it does best

Sometimes several of the Great Observatories are used to look at the same object. Astronomers can analyze an object thoroughly by studying it in many different kinds of light. An object will look different in X-ray, visible, and infrared light.

The images at right show the remains of an exploded star (Kepler's supernova), as seen by three of the Great Observatories.



Boxed areas in upper row are enlarged in lower row.

Return to "Era: Space Telescopes"

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